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THE STATUS OF THE SOUTH INDIAN BLACK LEAF-MONKEY (*PRESBYTIS JOHNII*) IN THE PALNI HILLS¹

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(With a text-figure)

Short surveys were conducted in 1976 in the Palni Hills, Western Ghats, to assess the status of the black leaf-monkey *Presbytis johnii* (the "Nilgiri langur") and its forest habitat. Evergreen forest was found to be patchily distributed in the hills and only some of the patches contained leaf-monkeys. I estimate that between only 150 and 500 leaf-monkeys survive in the Palnis, mostly on the south western escarpment. The leaf-monkey population is under pressure from man through habitat destruction and hunting. Action is recommended to alleviate these threats.

INTRODUCTION

The Nilgiri langur or S. Indian black leaf-monkey³ is listed as "vulnerable" in the I.U.C.N. Red Data Book (Goodwin & Hol-

loway 1972). But accurate information on the status of the species throughout its range is not available. A recent report on its status by Kurup (1975) covered in detail only parts of the area from which it has been recorded

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³ I prefer this term to the commonly-used "Nilgiri langur" since the species occurs in many hill

areas in addition to the Nilgiris and is known locally as "black monkey" rather than "langur". "Langur" is a Hindi word which applies specifically to *Presbytis entellus*. "Leaf-monkey" is frequently used with reference to the Southeast Asian members of the genus *Presbytis*.

(distribution data are summarized by Daniel & Kannan [1967] and Oates in press). To fill some of the gaps in information on the species' present abundance, and to complement an intensive ecological study being undertaken at one locality in Tirunelveli District, I have made surveys in two hill ranges (Palni and Ashambu) not treated in the reports of Krishnan (1971) and Kurup (1975). This report covers the Palni Hills.

NATURAL HISTORY OF *Presbytis johnii*

Apart from light reddish-brown hair on the head and (in females) white thigh patches, *Presbytis johnii* has an entirely black coat. It is characteristically an inhabitant of evergreen forest, including relatively thin strips of riverine gallery forest bordered by other vegetation types. It is herbivorous and its diet includes large quantities of tree leaves. Black leaf-monkeys typically live in social groups, often of 10-20 animals, with a single adult male. The adult male has a characteristic loud whooping call, which is frequently produced at or soon after dawn (Tanaka 1965; Poirier 1969, 1970a, 1970b; Horwich 1972; personal observation).

Although black leaf-monkeys probably always base their activities in evergreen forest, they do occasionally enter other habitats. McCann (1933) says that they may frequently be seen crossing open stretches of grass between *sholas* (evergreen forest in valleys) and notes the monkeys sunning in the topmost branches of tall, planted *Eucalyptus* trees near *sholas*. Prater (1971) notes that they may invade gardens and belts of cultivated woodland. In the Ashambu Hills they occur at very low elevations in river valleys (down to approx. 108 m alt.) and may also be seen feeding in open deciduous woodland some way

from the riverine forest (personal observation). In the Nilgiri and Palni Hills, *Presbytis johnii* is found as high as 2400 m alt. (Poirier 1970a; M.A.R. Khan personal communication; this report, below).

DESCRIPTION OF THE PALNI HILLS

The Palnis (or Pulneys) are the north-eastern spur of that section of the Western Ghat mountains which stretches from the Ariankavu Pass (9°00'N) to the Palghat Gap (10°35'N). They extend east-north-east for some 65 km from the valley of the upper Ten Ar River at approx. 77°15'E* to 77°50'E, just west of the town of Dindigul. If their foot is taken as the 500 m contour, their width varies between 20 and 40 km (between latitudes 10°01'N and 10°27'N) (see Fig. 1). The hills rise by steep escarpments to a high, undulating plateau, much of which is above 2000 m and whose highest point is Vembadi Shola peak (2508 m; 8221 ft).

Climate varies over the range, but much of the plateau receives an average of more than 1200 mm of rainfall annually with no more than four dry months. The southern face of the hills is wetter than the northern. In the higher areas mean temperatures in the coolest month are below 15°C. At the main town on the plateau, the hill station of Kodaikanal (10°14'N, 77°29'E; 2343 m alt.), temperature varies between a mean monthly minimum of 8.1°C and a mean monthly maximum of 18.5°C. Blasco (1971) gives details of the Palni climate.

Over much of the Palni plateau the "natural" vegetation is a short-grass montane savanna, often dotted with small trees of *Rhododendron arboreum* var. *nilagarica*. The various

* Taken by Kurup (1975) as the eastern boundary of the Anaimalai Hills in his survey.

STATUS OF PRESBYTIS JOHNI IN THE PALNI HILLS

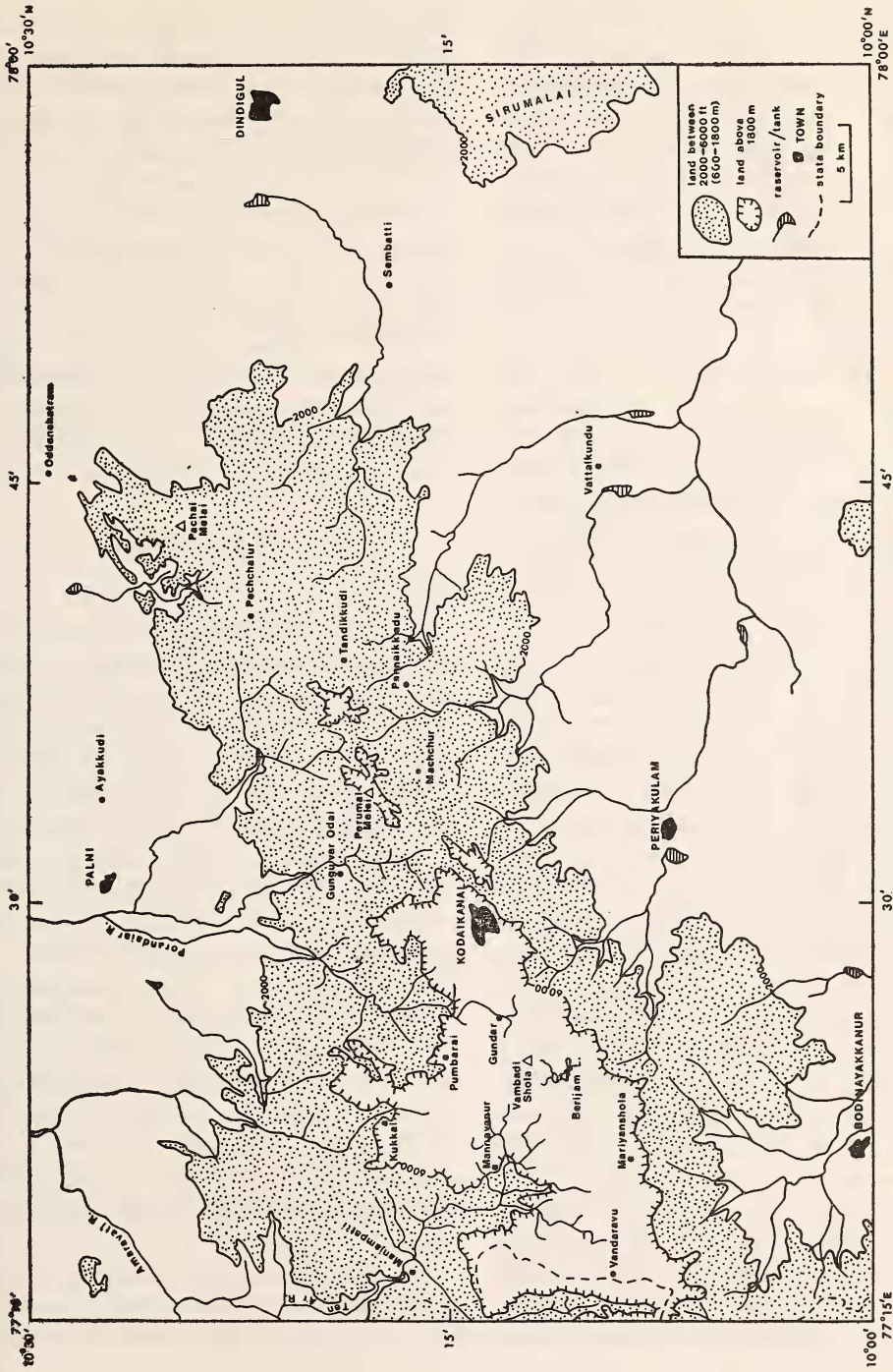


Fig. 1. Map of the Palni Hills, showing localities mentioned in the text.

savanna formations are described by Blasco (1971), who believes that savannas in these areas result primarily from the influence of fire, presumably generated by human hunters and graziers. The plateau forests are thus largely restricted to sheltered ("encaissées") valleys on well-drained soils. The "savannization" of the S. Indian high plateaux is provisionally dated by Blasco to within the last 3000 years. Burning still occurs in the grasslands today.

Since the opening-up of the Palni Hills from the latter part of the 19th century, large areas of the plateau have been planted with gum (*Eucalyptus* spp.) and wattle (*Acacia* spp.). Today many of the remaining tracts of savanna are being ploughed initially for potato cultivation, but with young trees, especially pines, being planted amongst the potatoes to supersede the vegetable crop.

The surviving evergreen forests of the upper elevations of the Palnis are divided by Blasco into *ridge forests* ("forêts de crêtes") and, in valleys, *sholas*. Both types survive only in small patches on the plateau, and ridge forests are particularly scarce. Although forest disappearance seems to have been a long-term process, in action for thousands of years, a certain amount of shola has been felled within recent times—Blasco notes the destruction of Bear Shola near Kodaikanal between 1963 and 1970 and the felling since 1969 of 400 hectares of shola covering the upper basin of the Ten Ar River. However, present Forest Department policy seems to be to protect, at least nominally, what little evergreen plateau forest that remains.

Shola forests also occur on the upper escarpments of the Palnis, and are an abundant vegetation type in precipitous valleys on the wet southwestern face of the hills. Evergreen forest apparently once extended down these

valleys almost to the plains. The natural vegetation of the southern and eastern slopes of the Palnis, apart from the sholas of the wet valleys, is semi-deciduous forest, and on the northern slopes dry deciduous forest. Below about 900 m the forest becomes scrubby. It was evident from my survey that parts of the northern slopes are heavily grazed by cattle, and that up to around 1300 m the eastern slopes carry extensive plantations, particularly of coffee, bananas and silk-cotton trees. The encroachment of the Palni vegetation by Kumari potato cultivation on the plateau and by plantations at the foot of the hills is also described by Davidar (1975).

THE SURVEY

Methods:

The Palni Hills were visited from 4-10 June and 28-29 July 1976. The survey consisted of three main parts: (a) driving through the range by Jeep, noting the status of the vegetation and questioning people by the road and at settlements on their knowledge of black leaf-monkeys (this was done mainly through a Tamil-speaking field assistant, Mr. D. Michael); (b) interviewing individuals with a knowledge of the vegetation and fauna of large parts of the range (i.e. officers of the Tamil Nadu Forest Department and H. H. the Raja of Pudukkottai in Kodaikanal); and (c) visiting areas of forest which reports suggested to be particularly promising as leaf-monkey habitats—I walked through these forests, noting details of the flora and fauna and searching for monkeys. I also listened for their unmistakable loud calls (particularly at dawn).

The route taken on the June survey was the main ghat road ("Law's Ghat") from Vattalkundu to Kodaikanal, from Kodaikanal east

on the Cochin road to Berijam (10°11'N, 77°24'E) and then on as far as Mariyanshola (10°09'N, 77°21'E), from Mariyanshola back to Berijam and then north *via* Mannavanur to Kukkal (10°17'N, 77°22'E), from Kukkal *via* Pumbarai and Gundar (10°13'N, 77°26'E) to Kodaikanal, from Kodaikanal *via* Pannaikadu to Tandikkudi (10°18'N, 77°39'E), and from Tandikkudi east to the plains near Sembatti (see Fig. 1). In July the northeastern section of the hills was visited, driving up from the plains at Oddanchatram to Pachchalur (10°22'N, 77°40'E), and from there for a short distance towards Tandikkudi, before returning to the plains by the same route.

Results from general survey and interviews:

This survey, and information obtained at interviews, made it clear that rather little suitable *Presbytis johnii* habitat (evergreen forest in a relatively undisturbed state) survives in the Palnis, as has already been noted in such publications as Spillett (1968) and Blasco (1971).

My observations indicate that the remaining areas of evergreen forest in the Palnis are:

(i) Close to rivers in the valleys along the southern face of the hills to the east of Kodaikanal.

(ii) "Tiger Shola" on a hillside just east of Kodaikanal.

(iii) On the southern edge of the plateau and on the steep southern escarpment from Kodaikanal west to the Kerala border near Top Station.

(iv) In patches on the edge of the plateau near Kukkal.

(v) A patch near Gundar, close to the road between Pumbarai and Kodaikanal.

(iv) At Gunguvar Odai, north of Kodaikanal towards Palni town (reported by H. H. the Raja of Pudukkottai).

(vii) Small patches on the flanks of Perumal Malai peak (2234 m; 10°18'N, 77°34'E).

(viii) In an area called Andialai, 2 km south of Tandikkudi, where the forest is underplanted with cardamom.

(ix) Small patches around Pachchalur, some underplanted with cardamom.

(x) Close to the summit of Pachai Malai (1299 m; 10°24'N, 77°43'E); this very small area of forest was observed only from lower on the hill (where the vegetation was dry woodland) and its exact character was not determined.

Areas (iii), (iv) (v) and (x) were examined on foot and are described in detail in the next section. Interviews suggested that the status of black leaf-monkeys in the other areas (in which the canopy was in most cases scanned with binoculars) is as follows:

(i) Leaf-monkeys seem to be almost entirely absent from the southeastern valleys, but 2 men reported that they occur below Machur on the road between the settlements of Oothu and Perumalalai, in the valley of the "Thalasiar" river. The valley vegetation there is below 1000 m altitude. Bonnet macaques (*Macaca radiata*) were reported from forests near the road and one group was seen at an altitude of about 1300 m.

(ii) No leaf-monkeys occur in Tiger Shola (Forest Department and H.H. the Raja of Pudukkottai).

(iii) H.H. the Raja of Pudukkottai reports that a few *P. johnii* occur at Gunguvar Odai, but that they are very difficult to find. This is probably at the headwaters of the Thevan-kariar River.

(iv) A few leaf-monkeys may survive in the sholas on Perumal Malai. Some people said they were or might have been found there, others said there were none.

(v) Careful questioning of several people

who had lived at Tandikkuddi all their lives, or who worked in or near the cardamom estate, produced the response that there are no leaf-monkeys in the Andialai forest. However, *M. radiata* was said to be present, and one group of this species was seen by the road between Tandikkuddi and Pannaikkadu at an altitude of 1300 m.

(vi) It is probable that no leaf-monkeys exist today near Pachchalur (about 1250 m alt.). Many people here were questioned. Several said that black monkeys were found at Champrankulam, between Pachchalur and Ayakkudi, but when closely interrogated on the monkeys' appearance it seemed clear that they were referring to *Presbytis entellus* and that they had in mind its black face. This is a caution that the mere statement of the presence of "black monkey" is unreliable evidence. Otherwise, everyone questioned said that no black monkeys existed near Pachchalur. One elderly man who had lived there all his life, who hunted in the forests and knew them well, was adamant on this point. However, E. Ugarte, S.J. (personal communication) recalls that he may have heard the call of *P. johnii* in the Pachchalur area around the year 1960.

Results from investigation of particular forests Southern escarpment

From near Kodaikanal west to the Kerala border near Top Station (a distance of about 25 m) most of the valleys running down the scarp face, and a few of the ridges, carry evergreen forest. The upper edge of the scarp lies at between 2000 and 2500 m, and the face drops away within a horizontal distance of some 2 km to an altitude of only 1000 m, where there is semi-deciduous forest. Between the patches of evergreen forest are open rock (often as near-perpendicular cliffs) and grassland. At one time, all these forest patches

would have probably been connected by evergreen forest at a lower altitude where the valleys meet. But today the low-altitude vegetation is much disturbed by man.

One of the most extensive patches of scarp forest is the Mathikettan shola on the edge of the escarpment near Berijam. This reaches downhill from about 2200 m altitude, and was investigated on foot on 5 June 1976 between 0944 and 1645 h. The area of continuous forest here was assessed to be at least 2 km² and perhaps more than 3 km². The largest trees in the area investigated were estimated to reach a height of 25m, with their crowns only occasionally in contact. Most of the large trees were identified as *Syzygium* sp. (possibly *S. arnottianum*) and *Cinnamomum wightii*, with a few *Elaeocarpus recurvatus*. *Actephila excelsa* was numerous in the middle tree-layer, and in the understory *Lasianthus* sp. was abundant. On parts of the forest floor were many *Calanthe veratrifolia* orchids. The woody vine *Toddalia asiatica* was common. A somewhat similar ridge forest in the Berijam basin is described in detail by Blasco (1971). [Plant identifications reported in this paper were made in the field by reference to Gamble & Fischer (1967) and Blasco (1971); they have not been confirmed by a botanist.]

In this forest animals belonging to one group of *P. johnii* were clearly seen and it was estimated that the group contained at least 10 animals. A second group of monkeys was heard but not clearly seen. The loud whooping call of an adult male *P. johnii* was heard across a valley to the southwest of the section of forest investigated on foot.

Several Malabar squirrels (*Ratufa indica*) were seen or heard in Mathikettan shola, and tracks and droppings probably belonging to gaur (*Bos gaurus*) were noted. A group of at least 13 *Macaca radiata* was seen to run

out of a wattle plantation at 2200 m adjacent to the forest and climb down the steep open cliffs of the escarpment.

On 6 June the scarp forest near Mariyanshola rest house was examined between 0905 and 1125 h. One shola of under 1 km² occupying a small valley was traversed on foot. It extended downhill from about 2300 m. The shola contained many *Cinnamomum wightii*. *Syzygium ? arnottianum* was also noted, and *Calanthe veratrifolia* was again abundant in patches. A common vine was tentatively identified as *Derris brevipes*. A group of *Macaca radiata* was sighted in this shola and the chirruping calls of Malabar squirrels were heard. A large animal, probably a sambar (*Cervus unicolor*), ran off on the forest floor without being seen. No leaf-monkeys were seen or heard in this forest, but a whooping call was heard from another belt of shola to the west, along the scarp towards "Land-Slip Hill". From "Pass Peak" (2390 m) two bouts of *P. johnii* whooping were heard from forest to the east of Mariyanshola (but west of Mathikkettan).

Therefore sightings and calls gave definite evidence of 4 - 5 distinct *P. johnii* adult males, each probably accompanying a group, on the scarp between Berijam and Land-Slip Hill (a distance of approximately 10 km). It is possible that at least twice this number of groups was actually present.

There is also forest on the scarp to the east of Berijam, towards Kodaikanal. *P. johnii* occurs in this forest, as evidenced by a whooping bout heard below Pillar Rocks only about 6 km from Kodaikanal. Although the scarp west of Land-Slip Hill (77°20'E) was not examined, leaf-monkeys almost certainly occur between there and Top Station. H. H. the Raja of Pudukkottai reports their occurrence near Vandaravu on the road to Top Station.

The isolated groups in the scattered sholas of this southwestern escarpment are certainly in vocal contact with each other and occasional physical contact probably occurs by means of terrestrial movement across the open ground between sholas. Such movement might be expected particularly from solitary large males without "their own" groups.

Kukkal

One relatively large patch of evergreen forest survives on the northwest edge of the Palni plateau west of the settlement of Kukkal. Over 50 years ago McCann collected a specimen of *P. johnii* at Kukkal (McCann 1933) and Forest Department officials in Kodaikanal reported to me the monkey's presence there.

I visited Kukkal from the evening of 6 June to the morning of 8 June, and the Kukkal Forest was explored on foot from 0725 to 1546 h on 7 June. The forest is described by Blasco (1971). It lies on the flanks and crest of a north-south ridge and is mostly between 1950 and 2100 m alt. Some tongues of forest reach to a lower altitude, especially to the west of the ridge where small valleys run down into the broad Ten Ar valley. On the east, drainage is into the Kudiraiyar River valley, which runs north off the plateau. The Kukkal Forest is roughly rectangular, extending approximately 4 km north-south and 2.5 km east-west, but there are extensive grassland intrusions into the rectangle. There are a few small patches of shola near Kukkal village but there is no other extensive area of evergreen forest in the vicinity. The climate of the north-western sector of the Palnis is, in general, drier than that of the southern escarpment.

My survey route through the Kukkal Forest followed existing paths west on to the ridge and then north, emerging on a grassy hill with a small temple at its summit (Papalai, alt.

2200 m). From here one could see most of the forest, and there was a fine view west towards Manjampatti in the Ten Ar valley, with the Anaimalai range rising behind. From this point near the north end of the forest I walked approximately south along the ridge through the length of the forest, emerging on another hill at the southern end. I then skirted the southeast of the forest, reentered it and travelled northeast back to Kukkal.

There was considerable variation in the vegetation between different parts of the forest. Near Kukkal, in the northeast quadrant of the forest, most of the large trees were identified as *Cinnamomum wightii*, *Beilschmiedia wightii*, *Pouteria tomentosa*, *Litsaea wightiana* and *Elaeocarpus oblongus*. These trees were mostly estimated to reach no more than 20 m in height, but occasional specimens of *Cinnamomum* were estimated to reach 30 m. In many places their crowns were not in contact and a thick layer of large herbs and shrubs covered the forest floor. The forest had a moist appearance in this area and land leeches were abundant. The more southerly parts of the forest examined seemed drier. Here there was a closed canopy and the understory was much more open. Amongst large trees *Cinnamomum wightii* was again common, but *Syzygium ? arnottianum* was also noted to be particularly abundant. A common small tree was tentatively identified as *Daphniphyllum neilgherrense*. On parts of the ridge crest there was a very stunted dry woodland.

I saw no black leaf-monkeys in the Kukkal Forest, nor any food remains nor droppings that might be attributed to them. However, the local guide, who seemed reliable, reported having seen black monkeys two months before our visit. Other people questioned at Kukkal said either that there were no black monkeys to be found nearby or that they were rare.

One man said that they were found only in the Ten Ar valley. During all the time I was at Kukkal, no black-monkey loud calls were heard, even though my camp had been set within 200-300 m of the forest.

The appearance of the Kukkal Forest suggested that it could support several groups of *Presbytis johnii* and the monkey was certainly present there at one time (as evidenced by McCann's specimen). But if it still survives at all at Kukkal it must be rare, and it may have been hunted to extinction. Although I heard probable gun shots from the direction of the forest on the evening of 7 June, people at Kukkal denied that monkeys are hunted there. This leaf-monkey is hunted in many parts of South India for its fur, meat and the supposed medicinal value of its blood and organs (Poirier 1970a).

Amongst other mammals at Kukkal, droppings and tracks of gaur were much in evidence, the scrapes and pug marks of a leopard (*Panthera pardus*) were seen, as were the droppings of wild dog (*Cuon alpinus*). One group of bonnet macaques was seen at the southeastern edge of the forest, at an altitude of 2150 m (these macaques do not have the commercial value of *P. johnii* and are therefore not subjected to the same hunting pressure). No Malabar squirrels were seen or heard, and there was no evidence of elephants (which had been reported to be abundant at Kukkal by Forest Department officers). Our guide, without any prompting, reported that Nilgiri tahr (*Hemitragus hylocrius*) occurred on cliffs to the northeast of the forest. He said he had seen five "varai aadu" there a few days before my visit. Davidar (1975) reports hearing of four tahr on the Kukkal cliffs. However, there were signs that the grass had been burned not long before my visit, and large herds of cattle (apparently from Manna-

vanur) were being pastured in the grasslands below the Kukkal Forest. This interference, combined with the possibility of unregulated hunting, does not favour the survival of a small, isolated tahr population.

Gundar

Several people reported to me the presence of *P. johnii* at Gundar, which I visited on the morning of 8 June. An investigation of an area of evergreen forest on a hillside close to the southeast of a Forest Department settlement and tree nursery was made on foot between 1000 and 1212 h. No other extensive area of evergreen forest could be seen near Gundar.

The Gundar shola extends south up a hillside from one of the upper branches of the Gundar River, which rises on the eastern flank of Vembadi Shola peak, close to the west of Kodaikanal, and flows north to join the Shenmukha River, a tributary of the Amaravati. It lies at approximately 2100 to 2250 m, occupies an area of about 1.0 to 1.5 km² and is surrounded by scrub, plantations of gum and wattle, and newly-cultivated potato fields. The largest shola trees were estimated to reach at least 25 m in height, with *Cinnamomum wightii*, *Beilschmiedia wightii*, *Elaeocarpus recurvatus*, *Syzygium ?arnottianum*, *Litsaea oleoides*, *Pouteria tomentosa* and *Elaeocarpus oblongus* present. What was probably *Daphniphyllum neilgherrense* grew in the middle layers of the forest and climbing *Toddalia asiatica* was identified. There was a fairly open understory, containing *Psychotria* sp. and *Lasianthus* sp. in the shrub layer, with *Calanthe veratrifolia* on the forest floor. There were some thick patches of bamboo at the forest edge.

This shola was traversed from east to west close to the river and then from west to east

higher up the hillside. No leaf-monkeys were seen or heard. Evidence of at least three Malabar squirrels was obtained from calls and sightings, and several squirrel nests were seen. The tracks and droppings of gaur were seen and there were signs of grubbing by pigs (*Sus scrofa*). The quill of a porcupine (*Hystrix indica*) was found on the forest floor. No land leeches were noticed.

Since people at Gundar were confident that *P. johnii* was present in this shola, and since my search had been short, I returned to Gundar at dawn on 10 June. At 0604 h and at 0707 h *P. johnii* whooping loud calls were heard from two separate sites in the shola. This indicated the presence of at least two adult male leaf-monkeys in the Gundar forest and probably therefore the presence of at least two social groups. No whooping was heard from any other location near Gundar.

Pachai Malai

This hill, visited on 28 and 29 July, was the only locality to the east of Perumal Malai where statements from local people suggested the possible presence of *P. johnii*. Many people at Nellikuli Kadu below the hill were questioned. Several claimed that black monkeys were present near the top of the hill. However, on closer questioning it was apparent that some of these people were referring to *P. entellus* and that most of them had not visited the hilltop but based their reports on hearsay, although a few claimed to have seen the monkeys themselves. A man who hunted in the area said that he had seen one black monkey with a group of bonnet macaques, one farmer described a monkey with a white tail and black body and head, and another described a completely black monkey with a black beard.

Pachai Malai lies in the dry northeastern

sector of the Palni Hills and is isolated from the main plateau. Most of the land surrounding the hill is cultivated. I climbed up to an altitude of about 850 m on the north flank of the hill on the evening of 28 July. The vegetation on the lower part of the hill bordering cultivated land (at about 650 m) is thorny scrub woodland with a very dense shrub layer, much disturbed by man. At 850 m the shrub layer is more open and the trees are larger (some reaching to around 20 m) but their crowns are mostly not in contact. The vegetation is best described as dry deciduous forest (or woodland) and is quite different from typical *P. johnii* habitat. During 1.5 h on the hill before dusk, no leaf-monkeys were seen or heard, but a single group of bonnet macaques was encountered.

A scan of the north face of Pachai Malai from below suggested that evergreen closed-canopy forest exists only in a small area (under 10 hectares) in a river valley near the summit of the hill. The south face of the hill was not examined.

For one hour from dawn on the morning of 29 July I waited on the crest of a low hill northwest of Pachai Malai, about 250 m from the forest edge. No monkey calls were heard.

In my judgment, it is unlikely that any black leaf-monkeys exist on Pachai Malai and I think H.H. the Raja of Pudukkottai is almost certainly correct in his view that none of these animals occurs today east of Perumal Malai. However, the reports made by local people cannot be entirely dismissed, especially as *P. johnii* is known to exploit open woodland at low elevations in the Ashambu Hills.

CONCLUSIONS

A few thousand years ago evergreen forests probably covered a major part of the upper Palni Hills, supporting a large population of

black leaf-monkeys. Today, such forest remains only in patches and only some of these patches still contain leaf-monkeys. Even 50 years ago the leaf-monkey was quite common in practically all the forests of the range (E. Ugarte, S.J., personal communication), and it was not uncommon in the environs of Kodaikanal town up to the mid-1950s (H.H. the Raja of Pudukkottai quoted in Daniel & Kannan 1967). According to the Raja, the species is still heavily hunted in the Palni Hills, both by local people and by hunters from the plains.

The largest remaining population seems to be on the southwestern escarpment of the hills. The number of leaf-monkeys living here probably falls somewhere between a minimum of 100 and a maximum of 300 individuals. Hunting may not be a significant problem close to Kodaikanal and Berijam, because of the proximity of Forest Department establishments, but it almost certainly occurs on the more remote parts of the scarp. Agricultural encroachment is damaging forest on the lower parts of the scarp. If this continues upwards there could be a serious reduction both in the extent of potential leaf-monkey habitat and in the frequency of contact between groups.

A few leaf-monkey groups survive in other areas, with at least two groups probably in the Gundar valley (which may be protected from hunting by its proximity to a Forest Department establishment and to the Kodaikanal road), but it seems unlikely that more than 15 groups (or perhaps 150-200 animals) survive in all areas other than the southwestern escarpment, and this could well be an overestimate. Tentatively I would therefore suggest a possible minimum of 150 leaf-monkeys in the Palni Hills in 1976 and a maximum (a rather unlikely maximum) of 500.

Although present Forest Department policy

seems to be preserve the patches of evergreen forest that remain in the Palnis, at least on the plateau, I think that the leaf-monkey population could still become extinct if further action is not taken. The following actions are recommended:

- (1) Taking stronger measures to prevent the hunting of monkeys (and of other animals). This requires paying more attention to areas, such as Kukkal, that are remote from large Forest Department establishments.
- (2) Halting agricultural encroachment on the forests of the lower hill-slopes, particularly the southern escarpment.
- (3) Giving special protection from cultivation, grazing and burning to any other vegetation which occupies a narrow gap between existing patches of evergreen forest, so that in the long term the patches will be more effectively linked for their populations of forest animals.

Even if these actions are taken and are effective, they may be too late to save leaf-monkeys from extinction in some isolated forests (e.g. Kukkal) that were once definitely occupied. If the monkeys do not naturally recolonize these forests after several years, consideration might be given to the introduction of animals from elsewhere. This would need great care. It should not involve the capture of wild monkeys unless they are from a population whose own habitat is being irreversibly destroyed. Captive animals confiscated by the Forest Department might be considered for reintroduction, but only where there is little danger of infecting wild animals with any diseases acquired by the captives.

Evergreen forest in the Palni Hills needs

protection not just because of its leaf-monkey population but because of the many other interesting species of plants and animals which it supports (and for a summary of important reasons for conserving shola forests in general, see Green & Minkowski [1977]). The semi-natural grasslands of the plateau also have great biological interest, but they are being converted rapidly into potato fields and plantations of exotic trees. Overgrazing by domestic livestock affects many parts of the foothills, and illegal hunting is probably widespread throughout the range. Davidar (1975) notes the threat to the Nilgiri tahr population on the southwestern escarpment posed by poaching, potato cultivation and cattle grazing. I understand that there are well advanced plans for bauxite mining in the vicinity of Mariyanshola. Such an operation could cause large-scale habitat disturbance.

If a significant proportion of the natural vegetation and its wild animal inhabitants in the Palnis is to survive, a careful examination must be made of the whole range of exploitative activities which are in progress or planned to assess how their impact might be mitigated. A detailed survey is required to provide information on the distribution and abundance of populations of all the large animals and to assess the status of the natural vegetation. Serious attention should be given to the idea of the Kodaikanal Hills sanctuary outlined by Spillett (1968). However, a sanctuary should include plateau areas and the southwest escarpment, and not just the deciduous forests up to 3000 ft (900 m) of the original proposal. Properly developed, such a sanctuary could only increase the attractiveness of Kodaikanal as a resort, which the spread of cultivation and the decline of wild-life surely cannot.

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